Chapter 17
Stoichiometry
↳ Molar Ratios
↳ Mol-Mol

ex: $Zn + 2HCl \longrightarrow ZnCl_2 + H_2$

1 atom Zn	2 molecules of HCl	1 fu $ZnCl_2$	1 molecule H_2
2 atoms Zn	4 molecules HCl	2 fu $ZnCl_2$	2 molecules H_2
3 atoms Zn	6 molecules HCl	3 fu $ZnCl_2$	3 molecules H_2
6.10^{23} atoms Zn	1.2×10^{24} molecules Zn	6×10^{23} fu $ZnCl_2$	6×10^{23} molecules H_2
= 1 mol Zn	= 2 mol HCl	= 1 mol $ZnCl_2$	= 1 mol H_2

★ ↳ Coefficients are the number of mols of reactants of products.

↳ $Zn + 2HCl \longrightarrow ZnCl_2 + H_2$

- Zinc to HCl ration (mols)

↳ $\frac{1 \text{ mol } Zn}{2 \text{ mol } HCl}$

ex: $N_2 + 3H_2 \longrightarrow 2NH_3$

↳ Molar Ratio:

N_2 to H_2 : $\frac{1 \text{ mol } N_2}{3 \text{ mol } H_2}$

H_2 to NH_3 : $\frac{3 \text{ mol } H_2}{2 \text{ mol } NH_3}$

↳ Inverse : $\frac{2 \text{ mol } NH_3}{3 \text{ mol } H_2}$

ex: $N_2 + 3H_2 \longrightarrow 2NH_3$

↳ Molar Ratio of H_2 to NH_3 : $\frac{3 \text{ mol } H_2}{2 \text{ mol } NH_3}$

↳ If 2.0 mol of NH_3 are produced, how many mols of H_2 were used?

- $2 \text{ mol } NH_3 \times \frac{3 \text{ mol } H_2}{2 \text{ mol } NH_3} = 3 \text{ mol } H_2$

↳ If 12 mol N_2 react, how many moles of NH_3 are produced?

- $12 \text{ mol } N_2 \times \frac{2 \text{ mol } NH_3}{1 \text{ mol } N_2} = 24 \text{ mol } NH_3$

ex: $C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$

↳ If 34.5 mols of O_2 react, how many mols of H_2O are produced?

- $34.5 \text{ mol } O_2 \times \frac{4 \text{ mols } H_2O}{5 \text{ mols } O_2} = 27.6 \text{ mol } H_2O$

Mass to Mass Stoichiometry

ex: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

↳ If 4g CH_4 react, what mass of water is produced?

✱ - TO convert between 2 things in a reaction, you must be in mols.

↳ $4\,g\,CH_4 \times \frac{1\,mol\,CH_4}{16\,g\,CH_4} = 0.25\,mol\,CH_4 \times \frac{2\,mol\,H_2O}{1\,mol\,CH_4} = 0.5\,mol\,H_2O \times \frac{18\,g\,H_2O}{1\,mol\,H_2O} = 9\,g\,H_2O$

ex: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

1. - If 17.5g of CO_2 are produced, how many mols of O_2 combusted?
2. - If 18.4mols CH_4 burn, how many grams of H_2O were produced?

① $17.5\,g\,CO_2 \times \frac{1\,mol\,CO_2}{44\,g\,CO_2} = 0.39\,mol\,CO_2 \times \frac{2\,mol\,O_2}{1\,mol\,CO_2} = 0.78\,mol\,O_2$

② $18.4\,mols\,CH_4 \times \frac{2\,mol\,H_2O}{1\,mol\,CH_4} = 36.8\,mol\,H_2O \times \frac{18\,g\,H_2O}{1\,mol\,H_2O} = 662.4\,g\,H_2O$

Theoretical Yield: Calculated yield based on Stoich.

Actual Yield: experimental yield → Amount of product from the experiment.

% Yield: $\frac{\text{actual yield}}{\text{Theoretical Yield}} \times 100\%$